Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/651
HUNGARY
February 1964
Submitted in:
ENGLISH and RUSSIAN

Confidential until official release during Conference

Abstract

THERMAL NEUTRON CROSS SECTIONS AND DIFFUSION PARAMETERS IN SEVERAL ORGANIC MATERIALS

L.Pál, É.Kisdi-Koszó, L.Bod, Z.Szatmáry and I.Vizi
Central Research Institute for Physics, Budapest

In the past few years considerable effort has been spent on measuring the influence of chemical binding on the scattering of slow neutrons in several hydrogenous liquids. This is important from practical point of view since the spectrum shape of neutrons in hydrogenous moderators depends on the binding effect. The quantitative understanding of neutron thermalization requires a fairly good knowledge of the scattering law for slow neutrons in hydrogenous liquids.

Unfortunately the determination of the scattering law involves rather large experimental difficulties. The measurement of the integral scattering cross section is simpler but it is not so sensitive to the details of the scattering system. In spite of this the knowledge of the integral cross sections may have importance in the calculation of the transport cross section. The temperature

dependent transport cross section can be obtained from the integral scattering cross section using the Radkowsky prescription which is rather useful but theoretically not rigorous.

The paper gives a detailed analysis of the Radkowsky prescription on the base of integral cross section and diffusion parameter measurements in several organic liquids /benzene, cyclohexane, n-hexane, toluene, xylene, and diphenyl/. The energy dependence of the integral neutron cross sections was measured by time of flight technique and calculated on the base of Zemach-Glauber's theory. The calculated data are in good agreement with the experimental results. The diffusion parameters were obtained from the measurements carried out with the pulsed neutron source method. The average transport cross section obtained from the cross section measurements was compared with the results of the pulsed source measurements. The comparison shows that using the Radkowsky prescription the calculated values of the transport cross sections are in fairly good agreement with those of the pulsed source measurements.

The transport cross sections were also calculated

from the data of $\sigma_s^H(E)$ for 1,3-butadiene since Petric et al. proposed the use of these data for the calculation of the transport cross sections in various hydrocarbons. Unfortunately the 1,3-butadiene data do not give satisfactory results, therefore the knowledge of the energy dependent cross section seems to be important in each of the investigated hydrocarbons for the calculation of the average transport cross section.

As a conclusion it should be emphasized that the Radkowsky prescription is to be considered rather as a useful tool, not as a theoretically rigorous treatment of the neutron scattering in moderators.